REMARKS

Claims 1-34 are pending in the present application after amendments. Claims 1, 17, 23 and 29 have been amended to distinctively claimed the invented subject matter. The amendments are supported by for example FIG. 3, [0041]—[0048]. No new matter has been introduced.

Claims 1-3, 6-7, 10-17, 20-23, 26-29, and 32-34 stand rejected under 35 USC 103(a) as being unpatentable over Huang et al. (US 6,067,292) in view of Storm et al. (US 2002/0131537)

Claims 1-3, 6-7, 10-17, 20-23, 26-29, and 32-34 stand rejected under 35 USC 103(a) as being unpatentable over Huang et al. in view of Storm et al. In the exemplary rejection to claim 1, the examiner alleges that Huang et al. disclose all of the subject matter in claim 1 except for specifically teaching identifying one or more signal components having one or more smallest channel coefficients based upon a channel estimate of said plurality of signal components and that Storm et al. teach the identification process; therefore it would have been obvious to use the system method of channel coefficient

estimation and noise reduction as taughted by Storm et al. to modify the system and method Huang et al. in order to recover the original transmission signal. This allegation is not supported by the cited references; applicants respectfully traverse the rejections for the following reasons.

1. The claimed subject matters

The claimed subject matters as represented by claim 1 are directed to methods and systems for reducing noise in a transformed signal having a plurality of signal components on different subcarriers. The reduced noise transformed signal is obtained by identifying one or more signal components having one or more smallest channel coefficients based upon a channel estimate of said plurality of signal components, reconstructing a predetermined number of times of the identified one or more signal components to thereby reduce noise, and replacing said identified one or more signal components for reconstruction with the reconstructed one or more signal components to provide a new transformed signal having one or more reconstructed signal components with reduced noise. As highlighted above, the reduced noise transformed signal is achieved by a sequence of operations that are not

taught or suggested by the cited references, even if the cited references are impermissibly combined.

2. No *prima facie* case of obviousness for Claims 1-3, 6-7, 10-17, 20-23, 26-29, and 32-34 over Huang et al. and Storm et al.

As discussed above, the claimed subject matters in Claims 1-3, 6-7, 10-17, 20-23, 26-29, and 32-34 have a feature of using a sequence of operations to obtain a reduced noise transformed signal. Huang et al. and Storm et a., even if impermissibly combined, fail to establish a *prima facie* case of obviousness for the following reasons.

<u>First, Understanding the "reconstruction and cancellation" process in Huang et al.</u>

The transmitted signal in the system of Huang et al is a summation of pilot and data (102 in FIG 1) i.e.

$$sg(t) = pi(t) + da(t) \qquad (1)$$

The signal arriving at the receiver after passing through the channel is a composite signal which includes L multipath components (illustrated in FIG 6, 601 and 602 for 2 paths). The multipath components are differed in attenuation α, phase ϕ and path delay τ (col 7 line 58-59). Thus we may write the received signal r(t) as (ignoring Gaussian noise for simplicity)

$$\begin{aligned} r(t) &= signal\_from\_path\_0 + \ldots + signal\_from\_path\_L-1 \\ &= \alpha_0 e^{j\phi_0} sg(t-\tau_0) + \ldots + \alpha_{L-1} e^{j\phi_{L-1}} sg(t-\tau_{L-1}) \end{aligned} \quad (2)$$

Substituting (2) with (1) gives

$$\begin{aligned} r(t) &= \alpha_0 e^{j\phi_0} pi(t-\tau_0) + \alpha_0 e^{j\phi_0} da(t-\tau_0) \\ &+ \ldots \\ &+ \alpha_{L-1} e^{j\phi_{L-1}} pi(t-\tau_{L-1}) + \alpha_{L-1} e^{j\phi_{L-1}} da(t-\tau_{L-1}) \end{aligned} \quad (3)$$

With reference to FIG 6, (3) with L=2 is the received signal before both blocks 611 and 612.

1. Their 1st step is to reconstruct pilot signal at each finger (col 8, line 2-6 or line 31-33). Take Finger 0 in FIG 6 for example, 606 reconstructs pilot signal 0, or $\alpha_0 e^{j\phi_0} pi(t-\tau_0)$.
2. The 2nd step is to cancel the reconstructed pilot signal at each of the other paths (col 8, line 9-11 or line 34-36). Again in FIG 6, 606 and 607 have reconstructed $\alpha_0 e^{j\phi_0} pi(t-\tau_0)$ and $\alpha_1 e^{j\phi_1} pi(t-\tau_1)$ respectively. For the upper branch, after the cancellation of the reconstructed pilot from path 1, i.e. $\alpha_1 e^{j\phi_1} pi(t-\tau_1)$, the signal will become (suppose reconstruction is perfect without error)

$$\begin{aligned} & r(t) - \alpha_1 e^{j\phi_1} pi(t-\tau_1) \\ &= \alpha_0 e^{j\phi_0} pi(t-\tau_0) + \alpha_0 e^{j\phi_0} da(t-\tau_0) \\ &+ \alpha_1 e^{j\phi_1} da(t-\tau_1) \end{aligned} \quad (4)$$

Similarly, the signal at the lower branch after the cancellation of $\alpha_0 e^{j\phi_0} pi(t-\tau_0)$ will be

$$\begin{aligned} & r(t) - \alpha_0 e^{j\phi_0} pi(t-\tau_0) \\ & = \alpha_0 e^{j\phi_0} da(t-\tau_0) \\ & + \alpha_1 e^{j\phi_1} pi(t-\tau_1) + \alpha_1 e^{j\phi_1} da(t-\tau_1) \end{aligned} \qquad (5)$$

3. The 3rd step is to use signals after cancellation (i.e. (4) and (5)) for demodulation.

<u>Second, comparing the "reconstruction and cancellation" process of Huang et al. above with the "reconstruction and replacing" process claimed in the present application</u>

In the presnt application, the signal components refer to the signals on multiple subcarriers instead of multipath components. The received signal **r** after passing through FFT module 412 is a vector in the format of (equation (2) at [0033] in the present application)

$$\begin{bmatrix} r_1 \\ \vdots \\ r_M \end{bmatrix} = \begin{bmatrix} \gamma_1 & & \\ & \ddots & \\ & & \gamma_M \end{bmatrix} \cdot W \cdot \begin{bmatrix} x_1 \\ \vdots \\ x_M \end{bmatrix} \qquad (6)$$

After demodulation of **x** in (6), our reconstruction and replacing process starts. For the convenience of comparison with the above reference, we also summarize the process into 3 steps.

1. Reconstruct only one ~~signal~~<u>component</u>, say $\overline{r_1}$ (can be extended to reconstruct a few ~~signals~~<u>components</u>)

2. Replace the component r_1 in the received signal **r** with $\overline{r_1}$. The resulting signal is

$$\begin{bmatrix} \overline{r_1} \\ \vdots \\ r_M \end{bmatrix}$$

Note that we are not subtracting the reconstruct component $\overline{r_1}$ from the received signal **r**

3. Use the signal from step 2 for demodulation again and these 3 steps repeat a few times iteratively. See, e.g., [0041]-[0045].

Third, Huang et al fail to teach or suggest the claimed subject matters of the present application

Huang et al. (col 7, lines 65-67, col 8, lines 1-22) do not disclose "**replacing** said one or more signal components with the reconstructed one or more signal components to provide a reconstructed transformed signal having one or more reconstructed signal components." Instead, they have disclosed **cancelled/subtracted** signal components from the reconstructed signal components. The process of "replacing" is significantly different from the process of "cancellation". A received composite signal is composed of multiple signal components. After reconstruction of one signal component, "cancellation" process is to

remove the reconstructed component from the composite signal. The remaining composite signal after each cancellation comprises one signal component less. However, our disclosed "replacing" process is to substitute the signal component in the received composite signal with the reconstructed component. The number of components in the composite signal after "replacing" process does not change. From "cancellation" process one can not deduce "replacing" process.

Fourth, Storm et al. fail to teach or suggest identifying one or more signal components having one or more smallest channel coefficients based upon a channel estimate

Storm et al. disclose a finite impulse response (FIR) filtering method which determines the FIR coefficients to minimize noise power and optimize the impulse response length. The reference is irrelevant to our patent application. Referring to FIG. 2 in Storm et al., Storm et al design a time-domain equalizer 210 with FIR coefficients determined based on channel impulse response and noise variance. Whereas in our patent application, we are addressing the issue of the signal detection or demodulation which is corresponding to the function block Demodulator 216 if we want to apply our technique to the same system.

We find that there's no ground to come to the conclusion regarding our claim 1 in the examination report (line 1-10 in page 4), namely that: "Storm et al. in the same field of endeavor teach identifying one or more signal components having one or more smallest channel coefficients based upon a channel estimate of said plurality of signal components (par 0052, lines 1-10, par 0067, lines 1-9) ... to use the system method of channel coefficient estimation and noise reduction as taught by Storm et al. to modify the system and method Huang et al. in order to recover the original transmission signal."

The method disclosed by Storm et al is used to determine filer coefficients based on the charnel impulse response and the noise covariance. This method does not deduce to our signal detection/demodulation algorithm. According to Storm et al (par 0052, lines 1-10, par 0067, lines 1-9), the FIR coefficients are *determined* based on the estimate of the time-domain channel impulse response and noise covariance. Moreover, Storm et al. does not employ or discuss the concept of ordering so as to obtain the *smallest* channel coefficients. However, in our method, we *select* the signal components corresponding to the smallest channel responses, and reconstruct a noise-free version.

We are not utilizing the noise covariance either. Furthermore, we use the reconstructed signal components (the components corresponding to the *smallest* channel response) to replace those received signal components.

Fifth, even if Huang et al. and Storm et al. are impermissibly combined, they fail to teach or suggest the claimed subject matter

As discussed above, the teachings from Huang et al. and Storm et al. are completely different from the claimed subject matter of the present application in terms of concept, principle and implementation. Even if Storm et al. and Huang et al. are impermissibly combined, they still fail to teach or suggest the claimed subject matters in the present application.

Therefore, the examiner fails to establish a *prima facie* case of obviousness for Claims 1-3, 6-7, 10-17, 20-23, 26-29, and 32-34 over Huang et al. and Storm et al.

Claims 4, 5, 8, 9, 18, 19, 24, 25, 30, and 31 stand rejected under 35 USC 103(a) as being unpatentable over Huang et al. in view of Storm et al. and further in view of Dabak et al. (US 2003/0002568)

Claims 4, 5, 8, 9, 18, 19, 24, 25, 30, and 31 stand rejected under 35 USC 103(a) as being unpatentable over Huang et al. in view of Storm et al. and further in view of Dabak et al. (US 2003/0002568). Applicants respectfully traverse the rejections for the reasons discussed above because Dabak fails to remedy any of defects in Huang et al. and Storm et al.

Conclusion

Claims 1-34 are not unpatentable over Huang et al. in view of Storm et al. or further in view of Dabak et al. for the above reasons even if they are impermissibly combined; therefore applicant respectfully request that the rejections be withdrawn.

Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,

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